Can Chilled Beams Contribute to Green Design?

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Guidance for Green Design?

LEED®-NC

Green Building Rating System
For New Construction &
Major Renovations

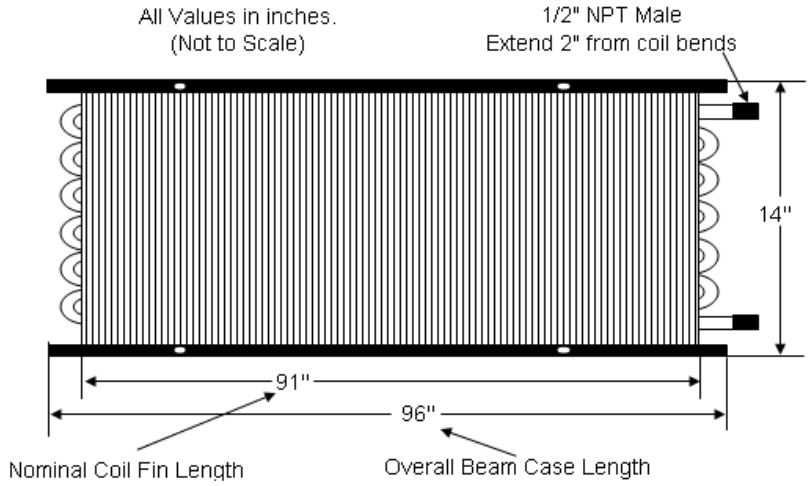
Areas of Green Design where Chilled Beams may generate points

- Sustainable Sites: *not likely*
- Water Efficiency: *not likely by themselves*
- Energy and Atmosphere: ***yes***
- Materials and Resources: *possibly*
- Indoor Environmental Quality: ***yes***
- Innovation & Design process: *possibly*

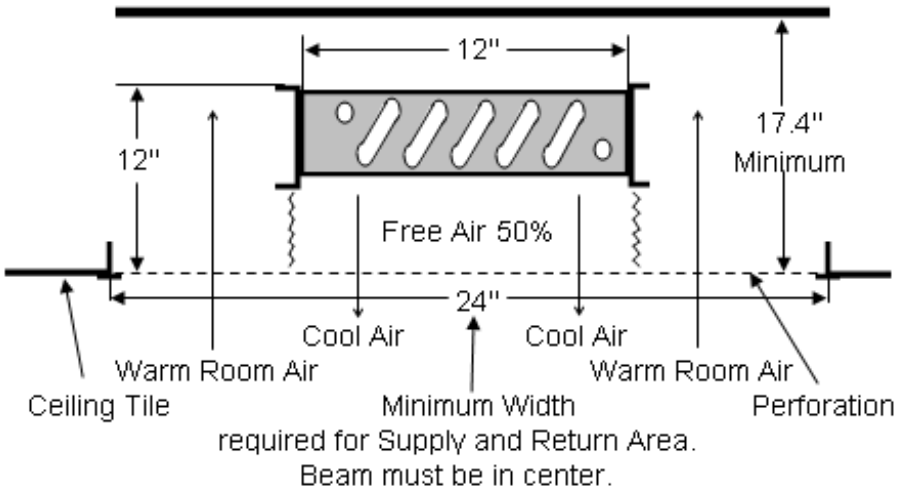
Chilled beam introduction

- Chilled beams are not what they sound like: **i.e. a cold I beam!**
- Chilled beams come in two forms, and are widely available from European manufacturers:
  - Passive
  - Active
- First used by Willis H. Carrier (then called induction boxes)

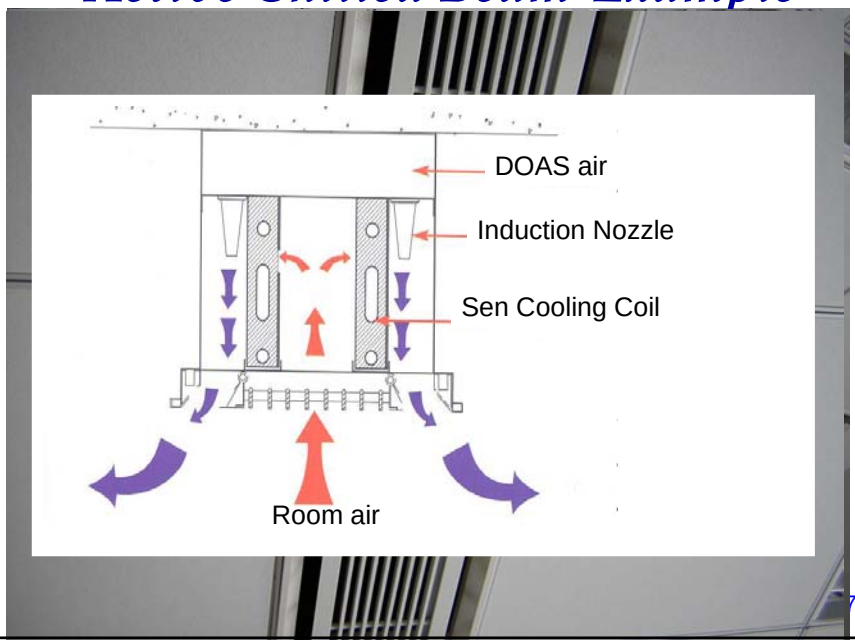
Passive Chilled Beam-example



Passive Chilled Beam-Example

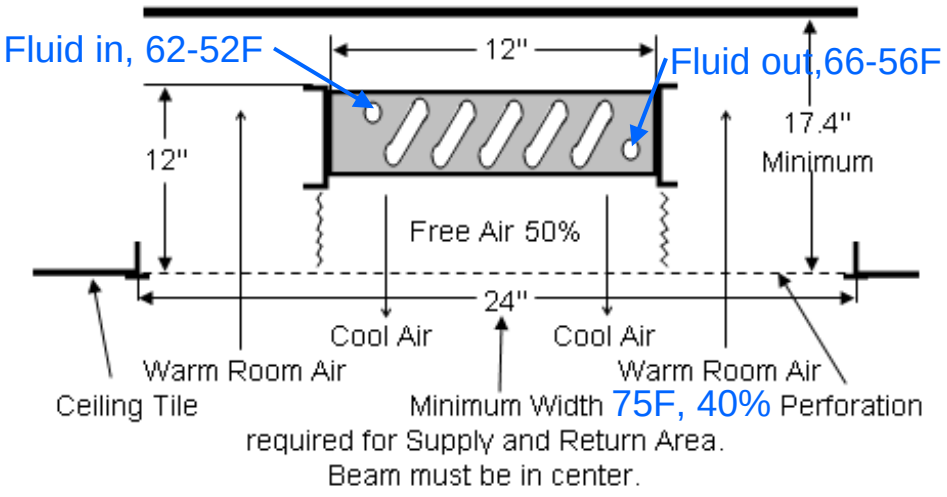


Active Chilled Beam-Example

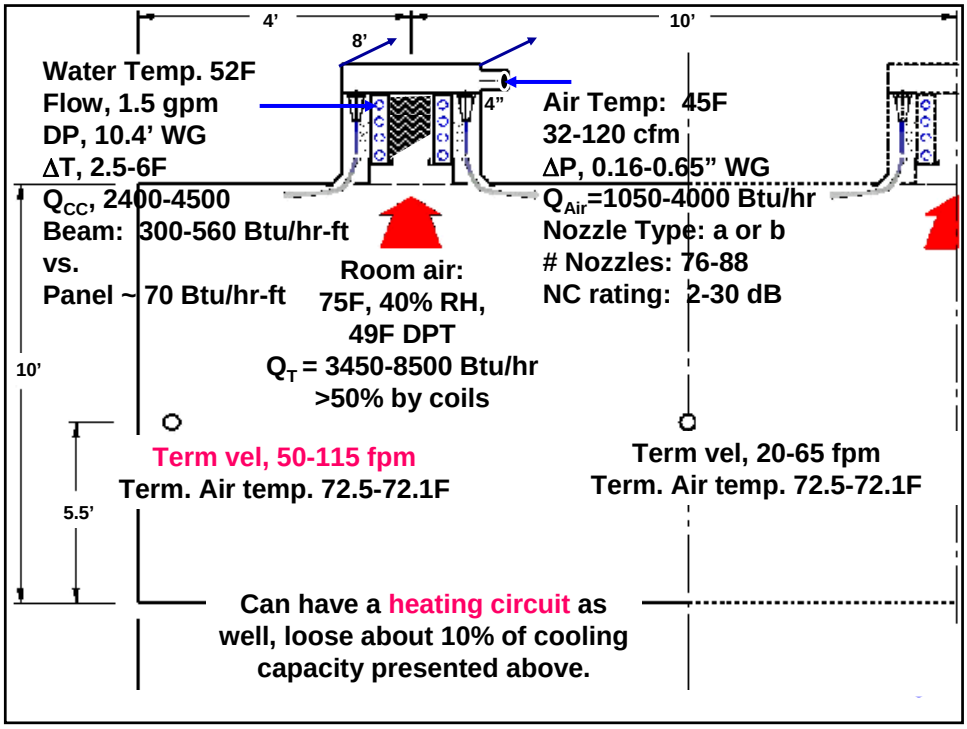


Passive Chilled Beam-Performance

Q_{Total}= up to 128-268 Btu/hr-linear ft cooling



32-46 fpm draft 3 ft below ceiling

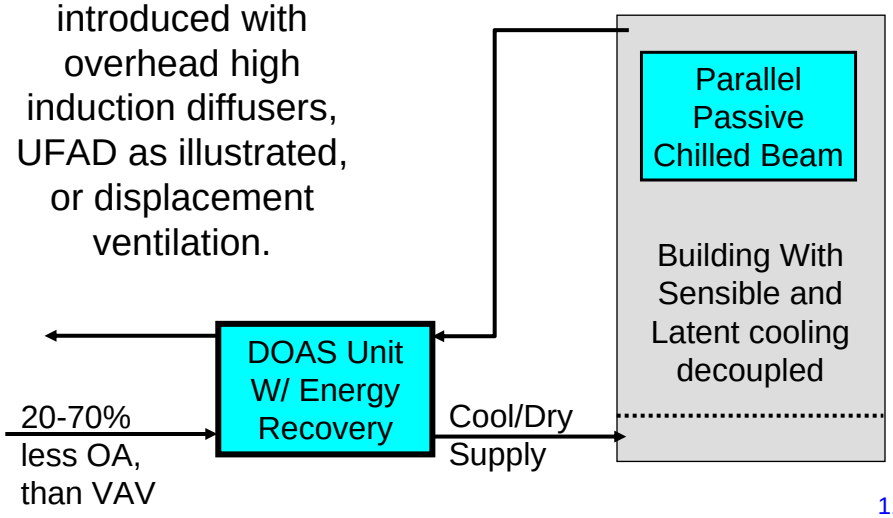


Performance Summary:

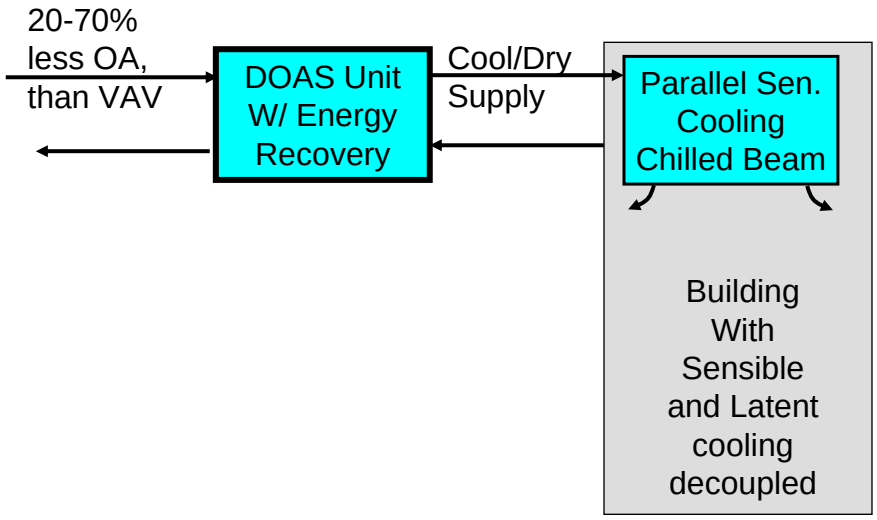
- Thermal performance: Good
- Comfort: Good, with design care in the areas of noise and air motion. Better than VAV, not as good as ceiling radiant cooling.
- Condensation, Always a control need.
- Is a good parallel system, since it needs a ventilation and dehumidification system--DOAS!
- What might that system look like?

DOAS with passive chilled beam

Ventilation can be introduced with overhead high induction diffusers, UFAD as illustrated, or displacement ventilation.



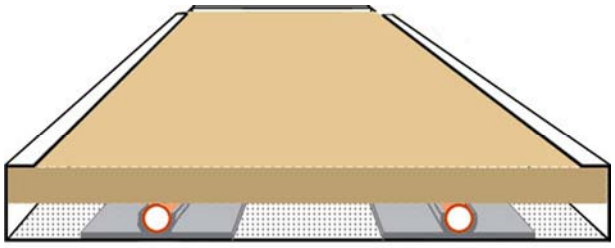
DOAS with active chilled beam



Attributes gained with the addition of DOAS

- Ventilation performance enhanced significantly
- The enthalpy wheel required by Std. 90.1, for most cases, greatly reduces:
  - Cooling and heating plant sizes (first cost)
  - Energy use and demand (operating cost)
  - Humidification (first and operating costs)
- No air is recirculated, offering distinct benefits with respect to transporting contagious pathogens or other undesirable agents (i.e. CBR) throughout the building.
- Greatly reduces the incidence of mold and other IAQ issues by decoupling the latent and sensible loads.

Compare with a Ceiling Radiant Cooling Panel



Compare with a Ceiling Radiant Cooling Panel

Where may the points come from when Chilled Beams and DOAS are integrated?

- ***Water use reduction***: In some climates the reduced water consumption for humidification can reduce water use by 20%.
- ***Optimize energy performance***: The chilled beam-DOAS system will reduce the energy used by the mechanical system in excess of 50%, so some points would be earned. The extent of points is a function total building energy percent reduction.

Where may the points come from when Chilled Beams and DOAS are integrated?

- ***Recycled Content:*** The aluminum, copper and steel in the chilled beams could have recycled content.
- ***Regional Materials:*** This will be possible in some cases in the future, when state side manufacturing becomes more common.
- ***IEQ***: Up to 5 categories could harvest points:
  - Outdoor air delivery monitoring,
  - Increases ventilation,
  - Zoning for enhanced thermal comfort,
  - Thermal comfort design as a result of controlled temperature, air motion, and humidity.
  - Thermal comfort verification, i.e. no more than 20% dissatisfied. With chilled beams, dissatisfaction runs well below that.

Where may the points come from when Chilled Beams and DOAS are integrated?

- ***Innovation:*** Since DOAS does not recirculate air, thus promoting health and safety, it may qualify for a point.

Conclusion:

- Chilled beams, active or passive, have the potential to generate green design points when used with DOAS to provide the required ventilation.
- Chilled beams represent a significant improvement over currently employed all-air systems in the areas of energy use and demand, IEQ, and they are challenging in the area of first cost.
- Chilled beams, at present, seem to be a little more cost competitive than ceiling radiant cooling panels.
- Unfortunately, ASHRAE literature is silent on the subject.
  - When this short coming is resolved, I expect to see much greater use of chilled beams.